ABSTRACT OF THE DISCLOSURE

Methods and apparatuses for determining entrained and/or dissolved gas content of gas-liquid mixtures. Data generated is used to control the True (air-free) or Apparent (air-containing) Density or Entrained Air content of liquids within optimum ranges, e.g. in paper coating processes and in the manufacture of food products, personal care products, pharmaceutical products, paints, petroleum blends, etc. For example, an indirect method of continuously determining the amount of gas entrained in a liquid, by: continuously measuring the temperature, flow rate, and apparent density of the mixture at two different pressure states, and calculating the volume percentage of the gas in the liquid by using equation (28)

$$x\% = \frac{V_s}{V_s + V} \qquad (28)$$

wherein V is the volume of the gas-free liquid calculated by equation (23)

$$V = \frac{1}{\rho_1} - \left[\frac{P_2}{P_2 - P_1} \left(\frac{1}{\rho_1} - \frac{1}{\rho_2} \right) - \frac{RT}{P_2 - P_1} g\left(\frac{\Delta P}{Q^a}\right) \right] \qquad (23)$$

in which P_1 and P_2 are two different ambient pressures and $\Delta P = P_2 - P_1$, ρ_1 and ρ_2 are apparent densities of the liquid sample measured at P_1 and P_2, respectively, R is the constant of the Ideal Gas Law, T is the liquid temperature, Q is the flow rate, $g(\Delta P/Q^a)$ is a function for determining the amount of gas being dissolved between P_2 and P_1, and V_s is determined by equation (27)

$$V_s = \frac{T_s}{T} \frac{P_1 P_2}{P_s (P_2 - P_1)} \left(\frac{1}{\rho_1} - \frac{1}{\rho_2} \right) - \frac{RT_s}{P_s} \left(\frac{P_1}{P_2 - P_1} g\left(\frac{\Delta P}{Q^a}\right) - g\left(\frac{P_1 - P_s}{Q^a} \right) \right) \qquad (27)$$